Templeton-Whitney Allotments
Head Cut and Photo Point Monitoring 2003-2010
Monitoring Summary and Report (DRAFT)

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Introduction

Baseline monitoring sites were created in summer 2003 within the Templeton and Whitney grazing allotments to help understand recovery rates at sites experiencing degraded conditions. The allotments were not grazed since 2000 and in a "rested" or currently un-grazed setting. As a result of an appeal of the 2000 Templeton-Whitney Allotments Grazing decision, the Forest was instructed by the Regional Office (Region 5) to conduct monitoring in order to understand rates of recovery over a ten year period and at a later date analyze the allotments to determine if future grazing uses are feasible.

Templeton-Whitney Allotments -Monitoring

Active head cuts, treated head cuts and other degraded sites in representative watersheds of the Templeton-Whitney allotments were selected for monitoring in similar settings as two actively grazed and neighboring allotments (Monache and Mulkey Allotments) for comparison as feasible, as a part of the overall monitoring plan to be undertaken on the allotments. The Monache and Mulkey allotments are not discussed further in this report and monitoring results are found in a separate report. Head cuts are defined as the top of an actively eroding stream channel or gully of various sizes that result in gully formation or incision below, and migration is caused by stream flow of various amounts and intensity over time as dictated by hydrologic processes, peak flow events and soil/vegetation conditions. Incised channels below head cuts in meadows tend to cause lowering of water table elevations and potentially cause shifts in vegetation types, and may reduce the ability of stream channels to disperse peak flows onto floodplains.

Treated head cuts (THC) are sites where previous treatment attempts were made to arrest head cut migration were set as photo-point monitoring sites to make visual, qualitative observations and to understand treatment effectiveness in various hydrologic settings. Photo-points were also established with markers and tags at degraded, unstable sites such as stream banks, gullies, and open riparian meadow sites within the representative monitoring areas. Previously created photo-points within the monitoring areas (circa 1997-1999) were repeated in 2003 and 2010 to give a broader range of perspective where available. Each monitoring site was given an alpha-numeric identity number (i.e., HC-332, THC 333, and PP-334) and corresponding tag at the site that was documented, mapped, photographed and initial written observations and measurements were made.

Monitoring site location maps are found in *Appendix A* and Head cut Monitoring Site Data are found in *Appendix B* (Table 1). See photos and descriptions document, *Templeton-Whitney Allotments HC and PP Monitoring photos* for site comparisons from 2003 to 2010 (separate document). Individual site per site monitoring results are also described and documented in an additional report.

Methodology

Active Head Cut Monitoring Sites

Head cut sites were set up with two fixed monuments (re-bar posts with copper caps) set into soil and aligned perpendicular with a level reference line (twine) to the current location of each head cut face (top) to establish a baseline to measure over time the amount of upstream migration that may occur. In addition, a meter tape was pulled from the left bank facing upstream monument (LBU) over to the right bank facing upstream monument (RBU) to measure distance to the current LBU location of the head cut channel, the location of the channel thalweg and measure thalweg depth and the location of the RBU of the head cut channel and measurements were

recorded. The monuments were placed apart enough in distance so they would not be affected by potential channel widening and a steel ID tag with a corresponding number (332, 334, etc.) was placed on the LBU monument for future identification. Photos were taken of each transect, channels and surrounding areas and monument locations for future reference along with recorded GPS positions later developed into GIS mapping and tables. A data dictionary (GPS) was utilized to collect site specific information at each site, i.e., vegetation types, slope, channel measurements, soil type, organic surface layer, aspect, and other transect measurements for reference and analysis considerations. With the established level reference line between monuments re-pulled at a later date along with a meter tape, the distance of upstream head cut migration along with widening and deepening of the channel could be measured, in this case seven years later. When the sites were revisited in 2010, this method was used along with measuring the lineal distance of any channel/gully migration that occurred since 2003. In addition, the width and depth of the current head cut and channel location was measured as well to help determine an estimation of soil loss associated with the head cut migration.

Photo-points

Photo-points were established with rebar or stone markers with fixed ID tags at degraded, unstable sites such as stream banks, gullies, and open riparian meadow sites within the representative monitoring areas. From the fixed monuments, repeat photos could be taken to replicate original photographs to visually track changes in vegetative cover, site stability and record observations. Selected treated head cut sites were also set up in a similar fashion to monitor treatment effectiveness and failures. Previously created photo-points within the monitoring areas (circa 1997-1999) were included.

Soil loss and Head Cut Migration Measurements

On Table 1, Appendix B the estimated amounts of soil loss and the distance of head cut migration is shown per site. The estimation of soil loss was determined by calculating a rectangular area by the width and depth of the channel at the original transect, calculating the same area at the new head cut 2010 location (measured manually with a tape) and using the length of migration to estimate cubic meters of soil loss. Head cut migration distance was measured in the field by using a meter tape from the original transect location (level line at transect between fixed monuments) to the new head cut location upstream, by following the channel thalweg on a lineal basis. With longer migrations over 5 meters, additional, random width and depth measurements were taken and averaged and used for the new head cut dimensions.

Monitoring Areas

Monitoring sites were established in the following areas within the allotments (maps in appendices show site locations). Templeton Allotment: Brown Meadow, Strawberry Meadow (upper and lower), Schaeffer Meadow, Death Canyon, Fat Cow Meadow and South Fork Tributary Meadow (near Brown Meadow). Whitney Allotment: Big Whitney Meadow (divided into five monitoring areas) and Stokes Stringer Meadows (divided into two monitoring areas). The monitoring areas/sites are discussed and summarized individually per allotment, showing monitoring results of the head cut sites, treated head cut sites and photo-point sites along with other observations.

Findings

The following descriptions are a summary of findings and other local information concerning the headcut, photo point and treated head cut monitoring areas established within the Templeton and Whitney grazing allotments, Inyo National Forest. Initial baseline monitoring sites were created in 2003 and monitoring was repeated in 2010. In addition, various informational site visits were made between 2003 and 2010 at a portion of the monitoring sites. In addition to collecting information at the monitoring sites, local watershed conditions were noted to

understand strengths and weaknesses of the meadows in terms of stability, head cut treatment effectiveness and overall condition trends since the grazing areas were rested in 2000.

TEMPLETON ALLOTMENT

Brown Meadow

Photo Point (PP) 338, Head Cut (HC) 332, 333, 334 and Administrative Pasture, Brown Cow Camp

Brown Meadow is a moderately extensive (approximately 2 miles in length) headwater meadow complex that drains into an unnamed tributary of the South Fork Kern River. Slope gradient is low to moderate (estimated 10 to 20 %). Several seeps and springs feed into the drainage (aka Brown Creek). Meadow type is variable from fairly dry xeric type uplands to more typical mesic meadow with some wetland areas.

PP 338 is located in the upper end of lower Brown Meadow and consists of an active HC with a large scour pool below with unstable banks. Since 2003, slow vegetative recovery of the stream banks has occurred and the HC has migrated very little. Floodplain vegetation has increased slightly. The site is fairly stable, but could be vulnerable to moderate erosion from grazing impacts.

The lower head cut sites (HC 332, HC 333) showed some moderate migration upstream, with slight channel widening and incision. The sites are located along a section of Brown Creek in a narrow floodplain reach with dry uplands nearby. Strong, well developed riparian vegetation, rock and cobble, and deep consolidated organic soil along the floodplain helped to minimize undercutting of stream banks and widening of the channel. Upstream migration was 5.79 meters for HC 332 and only 1 meter for HC 333. HC 332 has lessened in steepness at the headcut and appears to be adjusting to natural grade and slope, gully formation has started to decline. HC 333 is controlled by heavy willow growth and deeply rooted vegetation along the channel and should continue slow upstream movement (estimated < 0.30 cm per year). Overall stability at these two sites is good, with the exception of undercut banks directly below the head cuts. Floodplain vegetation is well developed and has increased in density and vigor since 2003 and is holding soil well making this reach of Brown Meadow fairly resistant to erosion and disturbance.

HC 334 is located in the mid-upper meadow adjacent to the Brown Cow camp where the meadow and floodplain area widens within the Forest Service administrative pasture (fenced). Two primary drainages meet at the lower end of this meadow and a fan of deep mostly unconsolidated alluvium exists beneath the meadow relatively shallow vegetative/organic layer, comprised of slope and channel materials from the steep upper watersheds (mostly de-composed granite materials with a lesser amount of organics). The organic horizon is fairly thin in this area and riparian vegetation is moderately productive and is comprised of various forbs and grasses with a lower density. Increased rodent activity is noticeable and bare soil areas exist sporadically through the site. The deep layered and non- cohesive subsoil in this area once saturated tends to erode at a high rate.

HC 334 is a highly active head cut found in an unstable meadow setting. It has migrated 3.90 meters and has widened and deepened considerably since 2003. The gully banks are collapsing and unstable, subject to further erosion form disturbance and flooding. Due to the relatively shallow organic layer and moderately strong plant rooting, soil once exposed is subject to moderate to severe rates of erosion. With future large runoff events, this HC is likely to migrate further upstream and deepen the gully.

In this area where HC 334 is located, four other active, untreated headcuts are found of various sizes and exhibit the same erosion and meadow soil/vegetation characteristics. Additionally, in the main channel of Brown Creek, the Forest attempted to stabilize two large and active headcuts using a log headwall and rock chute method not established monitoring sites) in 1998. The two structures have failed and are no longer serviceable. Active headcuts have re-established above the failed structures. The prescription was poor and the stabilization sites

were of a high risk due to the fairly unstable sod layer and loose, alluvial sub soil where water piping around structures occurred that lead to failure. The sites are now unstable and subject to further disturbance from grazing and flooding effects. The overall condition of this section of Brown Meadow may be fragile in terms of being able to resist impacts to grazing disturbance. Careful consideration of treatment methods will be important before any future stabilization effort is undertaken at the sites in the administrative pasture area to reduce the potential of treatment ineffectiveness.

Upper Brown Meadow – HC 335, PP 337 and Nine Treated Headcut Sites (THC)

The uppermost part of Brown Meadow is located upstream of the Cow Camp and administrative pasture. It is narrower than downstream and bordered by dense lodgepole forest. The soils are comprised of a deeper organic and A horizon with dense plant root composition that are moderately resistant to erosion. Floodplain vegetation is dense and vigorous. Stream flow tends to be overland with intermittent reaches of channel eventually forming a primary channel into Brown Meadow. Early summer the meadow is wet with seeps and small springs and it tends to dry in the late summer.

HC 335 is located near the uppermost part of Brown Meadow, above the treated head cut sites. Originally established as a monitoring site in 1999, the method used by the previous hydrologist was not understood and could not be repeated. In 2003, the site was set up using the new method. In 2010, the site was revisited and there was zero upstream movement. The headcut has become more vegetated on the cut banks and stable, while the gully below has aggraded and has begun to fill in with vegetation and soil. The site is very stable with dense rooted riparian vegetation and consolidated organic and A horizon sub soil, resistant to erosion and disturbance. No treatment is recommended.

PP 337 is a small area of stream side disturbance (bare soil banks) in upper Brown Meadow that was monitored to observe vegetative recovery of moderately elevated (approximately 0.75 cm above channel) and eroded stream banks in this area. Some minor vegetative recovery has occurred as seen in 2010 and it appears the healing of raw stream banks in this area is slow and should improve as floodplain conditions improve. The site may be vulnerable to disturbance until full vegetative recovery occurs.

THC's

Several small headcuts found in this area and a few larger have been treated by watershed crews in the 1990's and later in 2002. Two large headcuts were treated in 1998, one failed (THC 325) and was rebuilt in 2005 and the other (THC 237) was maintained and restructured in 2005. Several of the 2002 treatments were upgraded and maintained in 2005 as well. These sites were assessed in 2003 when baseline monitoring was established as THC's and were revisited in 2010.

A total of nine headcuts were treated in upper Brown Meadow since 1998, seven were done in 2002 (see narrative on South Fork Tributary Meadow for methods used). When revisited in 2010, all of the structures have continued to be effective in arresting head cut migration and have stabilized with surrounding vegetation. A few minor maintenance items would be useful, however, for the most part the structures have taken hold very well and floodplain vegetation has taken over as the stabilizing factor which is the primary objective of the treatments.

Adequate prescription and favorable hydrologic and environmental factors helped to meet treatment objectives. Due to the well-developed vegetation, rooting, moist organic soil and deep "A" horizon combined with low gradient and the opportunity to complete work during a rest from grazing disturbance provided a setting to have a higher probability for treatment effectiveness and to meet objectives. Maintenance of the structures also proved to be critical for success as without upgrades a higher percentage of failure may likely occurred. Several photos are on file of the THC sites from 2002 to 2010 that show trend and effectiveness.

Both successful and unsuccessful factors learned at the upper meadow and within the administrative pasture at Brown Meadow should be used when considering future headcut treatments in similar settings on the Kern

Plateau to increase project effectiveness. Without grazing pressure, the probability of treatment effectiveness was increased considerably as the sites were able to stabilize without disturbance.

South Fork Tributary Meadow

THC's 234 through 224, PP 330

South Fork Tributary Meadow (SFTM), an unnamed tributary is located ½ mile northwest of Brown Meadow and drains into the South Fork Kern River ½ mile south of the Strawberry Creek confluence east of the river. A small, mostly mesic type meadow that tends to be dry in comparison to most of the larger study area meadows, it is somewhat representative of overland-sheet flow type meadows within drainage headwaters on the allotments. Gradient is moderately steep ranging for 10 to 25%. Flow regime is primarily an overland sheet flow with little channel form. Vegetative density is moderate to strong over the meadow and the site is fairly well drained due to the steepness with small areas of bare ground mixed within. Organic – A horizon soil is fairly deep and has healthy rooting depth, similar to upper Brown Meadow and favorable for headcut treatment applications.

In 2002, 11 small to medium sized and disconnected headcuts were identified for stabilization treatments and treatments were implemented by Forest watershed crews. The headcuts were found in swales (low points) where flow concentrates and small incisions were made likely caused by grazing disturbance. The treatments consist of sloping headcuts back to match existing grade within the concentrated area of flow (thalweg). Geo-textile filter cloth was used as an underlayment to protect sub soil from erosion and small boulder and rock from local sources was placed on top to form a "chute" to allow flow to bypass the treatment site and slow stream flow energy. This same method was used for Brown Meadow THC's as well.

In 2003, these 11 sites were set up for treated headcut monitoring and mapped. In 2005, a portion of the treatments were in need of maintenance and adjustments were completed that summer. In 2010 the sites were revisited and evaluated. Out of the eleven, four have shown some ineffectiveness. One has failed with the HC advancing upstream and needs rebuilding, one has poor design and needs minor restructuring and two have minor but easier maintenance needs. The meadow tends to be dry with drier soils, and where treatments were done in the drier soil sites there was more problems. Ground burrowing rodents appear to be more active in drier soils and have added to treatment instability as borrows tend to channel water and add erosion around perimeter of treatments. There was also poor design and prescription with these sites. The other 7 sites have held up well, are stabilizing very well and vegetation has increased around the structures providing good soil stability.

There is a need to return with a crew to complete maintenance, probably a few days work and some tune up of Brown Meadow THC's could be done as well. Overall, treatments were successful in stabilizing this meadow. Not having grazing pressure since 2003 was likely a factor in success.

PP 330 is located within the mid section of SFTM and was revisited in 2010. It is an area of eroded, bare ground within a swale with rodent activity and nick points. Erosion since 2003 was low to moderate, slow. Vegetative density has appeared to be decreased, possibly due to the meadow experiencing soil drying since 2003. Nick points are still unstable and exposed. This is a small area and not representative of the meadow condition overall. It is useful to note that sites like this in other areas may be slow to recover and may still be vulnerable to disturbance, as seen with PP 337 in upper Brown Meadow.

Strawberry Meadow and Upper Strawberry Creek

PP 345 1A, PP 345 2A, HC 349, THC 348

Strawberry Meadow is a large meadow area on lower Strawberry Creek above its confluence with the South Fork Kern River. The gradient is low (< 10 %) and a wide floodplain area exists. Strawberry Creek is moderately sinuous and has good stream bank stability overall. In 2003, two photo points were set up in the middle section of the meadow to observe riparian vegetation recovery at a key grazing area along Strawberry Creek.

PP 345 1A is situated along Strawberry Creek looking downstream over riparian area. In 2003, vegetation was depleted and less vigorous with areas of bare ground. The site was revisited in 2010 and the photo repeated. Improvement is obvious, a large increase of riparian vegetation has occurred such as dense and prolific willow development and vigorous sedge growth in the floodplain along the creek. The stream channel has narrowed, the banks are stable with vegetation and flood flows can easily access adjacent floodplains.
PP 345 2A is adjacent to PP 345 1A and shows a side view of the extensive willow development along Strawberry Creek and improvement of riparian conditions. In 2003, it looks over an area of heavy grazing use with bare ground and diminished vegetation. The monitoring shows that this area is resilient and can recover fairly well from extended grazing pressure.

HC 349 is located ¼ mile within the Templeton Cow Camp administrative pasture on upper Strawberry Creek. It is a small HC in the main channel on a low to moderate gradient. Meadow vegetation is robust and well-developed, organic layer is deep with a cohesive and deep rooted A horizon resistant to erosion. This area has a higher water table than downstream which helps vegetation to be productive and soils to be developed. Stream banks are sturdy with dense vegetation and are undercut. Channel is narrow and deep (low width to depth ratio) and flood flows can easily access the wide floodplain to dissipate stream energy. This head cut has migrated slowly, only 0.33 meters since 2003, likely due to the above noted conditions. No need for treatment at this site as it is stable and there is not a high threat of HC migration and gully formation. If treatment was necessary, this meadow soil and vegetation type would be favorable and should be considered at other sites when planning stabilization treatments. This area may be resistant to grazing impacts when not too wet.

THC 348 is located in upper Strawberry Creek, ½ mile below the Templeton Cow Camp. This HC was treated by Forest watershed crews in 1998. Treatment consisted of a log headwall keyed into banks with a filter cloth and rock chute. When evaluated in 2003, the treatment was holding and effective at arresting the head cut migration. When observed in 2010, the structure had failed and washed out, and a new, very active head cut and gully had advanced 33 meters upstream. The cause of the failure was likely caused by poor prescription and site conditions. The structure was placed on a meander bend where stream energy is focused on the outside bend. In addition, the existing soil and meadow conditions are not favorable for this type of treatment, the organic sod layer is thin and weak subsoil is comprised of unconsolidated, silty sand and gravels that easily erodes (deep alluvial soils). Rodent activity is prevalent along stream channels with this type of soil and vegetation structure and may have contributed to the failure. 2010 experienced a sudden spring runoff as runoff was delayed by a cold snowy spring and peak flows were unusually rapid and high, it appears that this was the mechanism to wash out the structure and cause head cut migration. Another HC 100 meters upstream of THC 348 that was treated in 1998 using the same method also failed and washed out with a new head cut and gully migrating 10 meters. This meadow condition needs to be carefully evaluated for proper prescription if future treatments are planned (high risk). This area may be vulnerable to grazing impacts due to overall weakness along stream banks and soil cover is not very strong due to the alluvial conditions.

Fat Cow Meadow (Tributary to Strawberry Meadow)

Two HC monitoring sites are located in Fat Cow Meadow, a moderately steep drainage that connects with Strawberry Meadow. A relatively small area, stream flow is seasonal, the channel is intermittent and mostly an overland flow type. Disturbed areas have formed head cuts and areas of bare ground. Organic horizon is rather thin and the A horizon is unconsolidated. Sub soil consists of a deep layer of unconsolidated cobble with gravel and sand. Overland flow slows erosion as flow energy is not concentrated and spread out over floodplain during peak flow events. Both HC monitoring sites did not exhibit much erosion or migration. HC 346 moved 0.85 meters and widened some and HC 347 only moved 0.45 meter since 2003. Due to overland flow energy dissipation and moderately developed floodplain vegetation erosion rates tend to be slow, the deep rock and cobble substrate adds to stability as well. The open soil areas are subject to grazing impacts that could increase erosion rates.

Schaeffer Meadow

Upper and Lower Meadows, HC and PP Monitoring Sites

Four HC sites and two PP sites are located in Schaeffer Meadow, a long and fairly narrow tributary drainage to the South Fork Kern River. The meadow had once incised most of its length historically and is now rebuilding a newer floodplain within the old incision. The stream channel is mostly an overland flow type with intermittent sections of defined channel until the lower reach where the defined channel is consistent to the river as gradient increases. Several head cuts of various size, disturbed and barren stream bank areas and small gullies are found within the developing floodplain along the reach of the meadow and are in an unstable condition. In between the disturbed sections, floodplain vegetation is robust and well developed and narrow in extent. Encroaching dry plant species with a mix of riparian species are evident along the narrow riparian corridor. It appears the upland species have slightly diminished since 2003, indicative of rising water tables in the area.

The head cut sites have shown slight migration since 2003, not migrating over 2 meters upstream. The gullies directly below have widened at the sites, due to scour pool (eddy) effect. Overall, the mostly consistent sod layer and well developed vegetation and floodplain attenuation in Schaeffer has helped to minimize extensive HC and gully migration. Stream banks around and below the HC's are vulnerable to disturbance, grazing effects would likely create more instability. Photo points are showing increases in vegetation and a general aggradation of floodplains as compared to 2003. This is likely contributed to by the overland flow regime of the meadow (flow energy dissipation, filtering of sediment and organics) and the recent cessation of grazing. The photo points also show that active erosion is occurring, although moderate in scale overall with some of the areas more severe.

Death Canyon/Death Canyon Tributary

Death Canyon is a tributary of Dry Creek, located near the Sierra Crest on the eastern side of the Kern Plateau. Where Death Canyon and another small tributary meet is where the monitoring sites are located. The riparian areas here are narrow except for the large meadow and key area of Death Canyon tributary. Three HC, three THC and three photo point sites are located in this area set up in 2003. The Death Canyon Tributary Meadow is a large, wide open meadow and floodplain and there is no defined stream channel. It has increased in vegetative cover since 2003 and appears to be stable. One photo point is located here that has shown vegetative improvement.

Below the meadow the drainage narrows and becomes moderately entrenched and the stream channel is defined in intermittent sections with overland flow areas until it confluences with Death Canyon. Deep rooted riparian vegetation and sod layer is well developed in this area with a deep well-structured A horizon. In this reach there are several large head cuts, disconnected from each other. They have not migrated much since I first observed in 1997. None have migrated more than 2.50 meters and have exhibited signs of increased vegetative stability. Soil erosion is slowed by large boulder and bedrock controls, dense vegetation and intact sod. Previous treatments (2002) have successfully stabilized the most active head cuts and threatening (2). Where active head cuts exist, the gully banks are barren, eroding and unstable and are continuing to erode, but slowly.

Death Canyon Creek is found in an older incised bed between terraces that is now a recovering, elevating floodplain. The stream is defined in some areas with overland flow reaches intermittent. The new floodplain is very robust and productive and is showing signs of rapid aggradation. The head cuts are still actively eroding and are unstable, however, are relatively slow (< 3 meters since 2003). Gullies are short below the HC's and rapidly fill in with vegetation due to the slow erosion rates. The large upstream watershed area contributes large amounts of sediment and organics and water tables are rising. This is likely the reason floodplain vegetation is robust and building, coupled with the lack of grazing pressure since 2000.

The treated head cut sites show very good effectiveness with stabilizing active head cuts. Factors for success include low gradient floodplain, healthy organic surface layer and plant density with an overland flow regime that reduces flood energy. Increased vegetative stability at the treatment sites is critical to treatment success as soil

and vegetation take hold and eventually the site returns to a stable hydrologic condition. The rate of recovery in this area appears to be rapid.

WHITNEY ALLOTMENT

Stokes Stringer, Section 1 (Lower)

Lower Stokes Stringer Meadow is larger in size than upper Stokes and has a two tributary streams joining Stokes Stringer. The upper and primary tributary has contributed large amounts of alluvial sediment to the upper area. Sod layer is thin and inconsistent, rooting depth is shallow in this area and the sub soil is comprised mostly of loose alluvial sediment that has a high erosion potential. HC 375 is located on this upper tributary. It has migrated 46 meters since 2003. In spring 2010 there was a sudden and high peak flow event of snowmelt that probably contributed to a large part of the head cut migration. Stream banks along the gully are very unstable and calving. The plant soil component in terms of sod cover and root density/retention is fairly weak in this area and is subject to grazing impacts. Stabilization treatments in this setting would constitute a high risk of failure and planning would need to be carefully analyzed. A photo point site (PP 376) in the upper tributary looking at bare soil terrace banks and bare soil floodplain area show slow vegetative recovery since 2003, an estimated 20 percent vegetation increase has occurred when observed in 2010. Terrace banks still exhibit a high percentage of bare mineral soil.

The lower end of Section 1 is wet, with a higher amount of organic surface layer and deep organic soil, vegetation is productive. Photo-points in this area have shown noticeable vegetative increases and building of floodplains, hummock and bare ground have diminished in size and area and have shown increased vegetative cover and stability. The area is very wet and it is obvious that the local water tables have elevated since 2003. Considering these conditions, this portion of section 1 is sensitive to disturbance and intense grazing may cause impacts that may reverse the upward trend in the short term.

Stokes Stringer, Section 2 (Upper)

Two head cut and two photo points are located in Upper Stokes Stringer Meadow, a tributary meadow east of Big Whitney Meadow. Upper Stokes is wet, several seeps and small springs are found and a small stream forms. Organic soil is deeper and well developed and overall floodplain vegetation is fairly robust. The site sustained heavy grazing pressure pre-2000. Small, head cuts have formed in the primary stream channel and are actively eroding. The head cuts and gullies tend to undermine more unconsolidated alluvial materials below the root zone and cause channel incision and undercutting/calving of stream banks, creating an unstable stream bank condition and lowering local water table. Head cut migration was at a moderate rate since 2003, HC 377 has moved 19.5 meters and HC 378 has moved 3.68 meters. With grazing pressure the stream bank conditions may worsen.

Big Whitney Meadow – Sections 1-5

To improve data collection for Amendment 6 in 1999 due to the variable site conditions and large area of Big Whitney Meadow, the meadow complex was divided into 5 sections (see map in appendices). This sectional reference was used for the head cut and photo-point monitoring of 2003-2010. Big Whitney Meadow is a high elevation site (near 10,000 feet) and exposed with a fairly harsh climate, vegetative growing season is short as compared to other Kern Plateau meadow sites. It is unique as well as it has been affected by glaciations and has glacial till characteristics and overall shallow soils. Large, high elevation (over 12,000 feet) drainage areas feed into Big Whitney mostly comprised of decomposed granite and granitic bedrock.

Section 1, Big Whitney Meadow

Section 1 is located in the north-west area of Big Whitney and forms a large part of the headwaters of Golden Trout Creek. The area is very wet with several seeps and upwelling springs forming small tributary streams to Golden Trout Creek. Water tables are commonly high and soils are saturated over a wide area into the late summer and early fall seasons. Large areas of naturally occurring bare ground exists due to the wetness and mineral leaching along with frost heave soil formations. Large areas of hummocks and bare ground from disturbance have been noted from past observations and monitoring sites were set up in these areas (photo points) in 1999 and 2003. This section is wet and is likely vulnerable to grazing impacts.

Two photo points have shown slow to moderate vegetative recovery in the eroded stream banks and hummock areas since 2003 and disturbed ground and hummocks are still present. Hummock areas are starting to diminish in relief and less bare soil is present as vegetation is filling in. Head cut 383 (HC 383) located in the lower reach of Section 1, showed a slow migration rate, 1.1 meters since 2003. Strong streamside vegetation and sod layer has helped to minimize migration. The channel above the head cut has normal width to depth ratio (narrow and deep) and accesses floodplain under normal peak flow conditions, dissipating stream energy and reducing erosion impact at the head cut.

THC's 88, 87, 85

Head cuts treated in 1999 were monitored as THC sites. Three THC sites are located in Section 1 in the northwest arm. The head cuts treated were small with sections of incised gully below. The area is wet with a static high water table. Vegetation is robust and soil had a deep organic horizon. Treatments consisted of sloping back head cuts to match existing grade, placing inka mat filter cloth and lining sloped channel (thalweg) with rock. One site was treated with a log headwall and rock chute application. All three sites have stabilized well and treatments were effective. Strong sod layer has grown into and around the structures and created very good stability. Vegetation has taken over, structures are not readily visible and sites are returning to natural hydrologic condition. It appears the lack of grazing pressure on the treatments coupled with favorable site conditions helped with treatment success.

Section 2, Big Whitney Meadow

Section 2 is located in the north east corner of Big Whitney Meadow where a main drainage from Cirque Peak enters. One head cut and one photo point monitoring site was established in 2003. Section 2 has a large watershed drainage area that feeds into the meadow from Cirque Peak on the Sierra Crest south to below Cottonwood Pass. Stokes Stringer is a tributary to this branch of Golden Trout Creek. In 2003 vegetation was noted as not well developed and the sod layer was partially displaced, bare ground and hummock areas existed. HC 380 was noted during 1999 observations as an active HC with a gully formed below and was set up in 2003 as a HC and photo-point monitoring site. The upper 1/3 of Section two was revisited in 2010 and distinctive changes were noted. This area had a dramatic increase in floodplain vegetation along the stream channel and sediment/organics deposition.

HC 380 was not visible due to major geomorphic changes to the landscape and channel that has occurred since 2003. Monitoring monuments could not be located thus follow up on channel data could not be collected. Obvious indications of flooding and sediment/organic deposition had occurred that filled in the channel and shifted the flow path to an overland flow with intermittent historic channel sections. Vegetation cover has increased providing good soil protection and sediment filtering ability. The large upstream watershed area can deliver large amounts of sediment and organics from upslope areas that can build meadow soils and increase vegetation density over a matter of a few years (probably less than 2-3 years). HC 383 has changed to a much smaller and less active head cut about 20 meters upstream and is slowed by dense riparian vegetation and deep organic soil layers. Photo point 380 is located near HC 380 in Section 2 adjacent to the active floodplain. In 2003, it was observed as a bare ground area with plant pedestals. Moderate improvement has occurred with vegetative cover when seen in 2010 with areas of bare ground still noticeable. This site is still unstable.

Section 4, Big Whitney Meadow

Section 4 is located along the western sides of Big Whitney Meadow. Two large meadow areas with large spring and seep areas exist to the west of Golden Trout Creek. Small streams that are tributary to Golden Trout Creek form in these areas. Large areas of hummocks and bare ground were noticed in 1999 and 2003. Treated head cuts were noted also. The meadows in Section 4 tend to be steep as compared to other Big Whitney sites. In 2010, the meadows were revisited. There was a marked increase of riparian vegetation at sites where in 2003 there was much less ground cover, bare ground and less vigorous vegetation. Water tables appear to be higher. Hummock areas have shown diminishment but are still prevalent and they are covered with more vegetation. Bare ground areas have filled in with more vegetation and stability has improved. Vegetative recovery rates at some of the photo point sites are high with a very noticeable change in terms of vegetation health and density. Small active head cuts still exist in the areas and have unstable stream banks along the gullies below. The sites are very wet and fragile, grazing pressure could cause a high amount of sod disturbance and expose soil as subsoil is very wet and some areas are saturated. Strong vegetative cover increases is likely due to the lack of grazing over the past 10 years. Hummock areas and compacted soil sites have lessened since 2000. This may have helped with hydrologic function and increased ground water storage that lead to stronger vegetative development and soil stability in the meadows.

Section 5, Big Whitney Meadow

Section 5 is located along a tributary drainage east of Golden Trout Creek near the lower end of Big Whitney and downstream to the outlet the meadow (southern end). Four photo points were established along this section in 1999 and repeated in 2003 and 2010. The area is moderately steep and narrow near the lower end and opens up and levels near the upper (eastern) end. Large areas of disturbed ground, hummocks, bare ground and several small in-channel head cuts were observed in 1999 and 2003. The site was revisited in 2010 and the photo points were repeated. Head cuts are still active in Section 5, two are large and unstable. The 1999 amendment 6 surveys note the head cuts and show locations on maps. Hummock and compacted soil areas have shown improvement, hummocks have less relief and soil has relaxed with the absence of grazing pressure since 1999.

Upper Section 5 (eastern end)
In the upper section, photo points have shown a marked increase in vegetation and terrace bank stability within the historically incised channel. It appears that floodplain within the incision is elevating and aggrading, water tables appear to be higher and floodplain vegetation is moving up terrace banks and terrace bank stability is improving. Bare soil areas are still visible on the terrace banks and would be subject to grazing disturbance that could reverse upward trend. The floodplain area within the incised channel and the lower terrace banks are very wet to saturated and fragile as water tables elevate and may not hold up to grazing pressure. See monitoring site photo document to see 2003-2010 site changes.

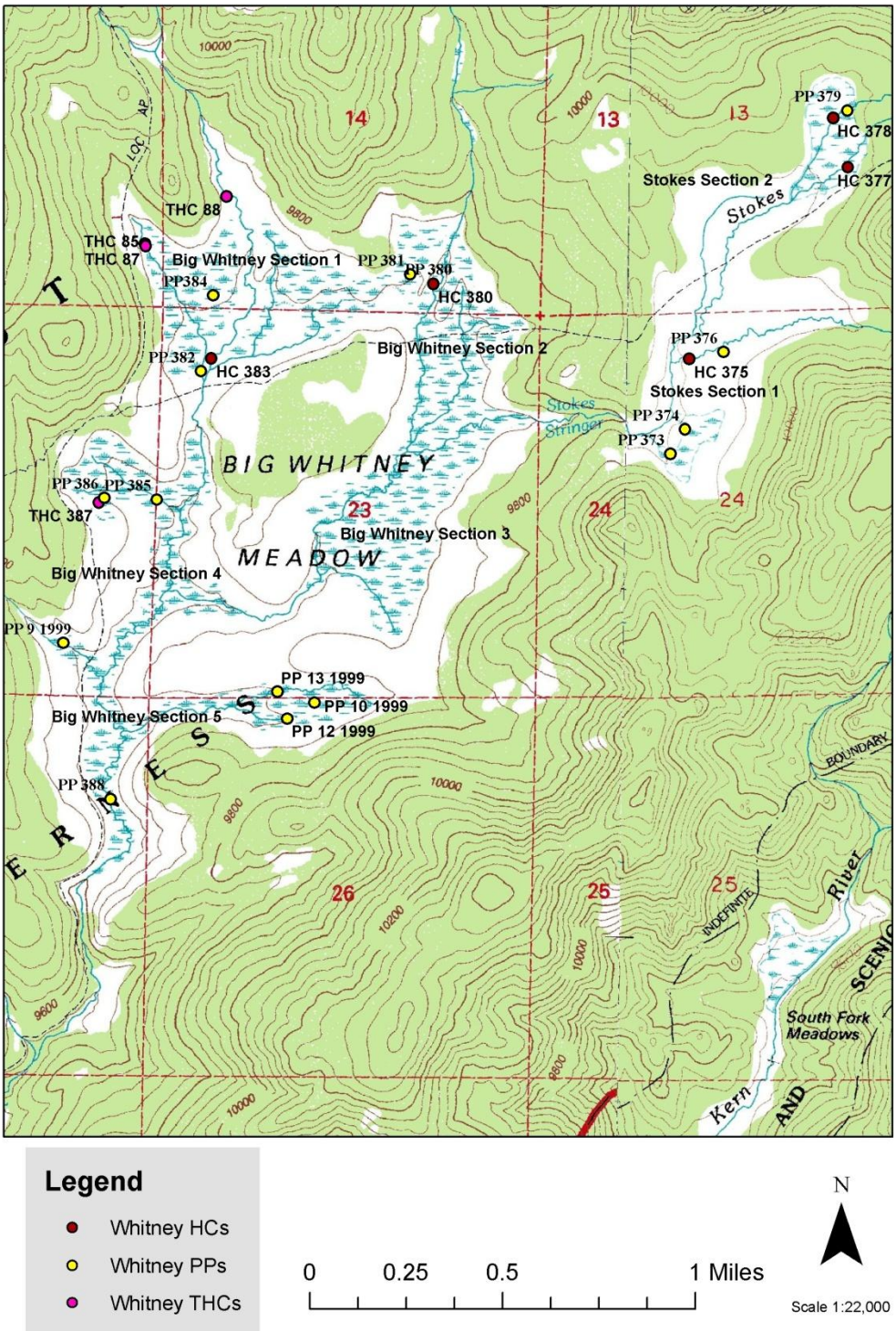
Acknowledgements

The following persons were instrumental with the establishment of field monitoring sites, methodology and with data collection in order to compile this report:

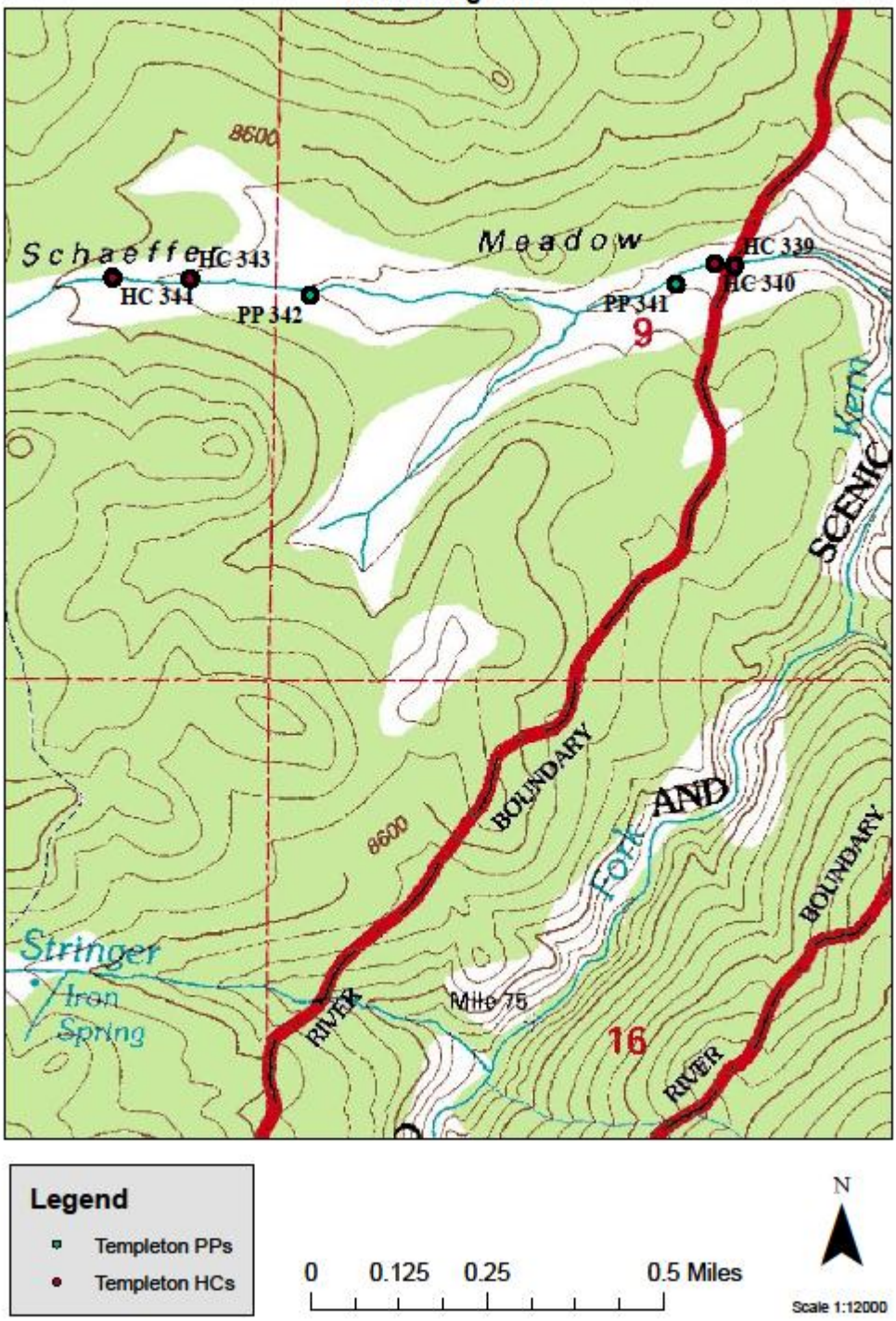
David Rains, Hydrologic Technician, Inyo National Forest, 2003
Heather Swartz, Range Conservationist, Inyo National Forest, 2003
Del Hubbs, Range Conservationist, Inyo National Forest, 2003
Sophia Berry, University of California Los Angeles – CAL-TROUT Intern, 2010
Lesley Yen, Presidential Management Fellow, Inyo National Forest, 2010

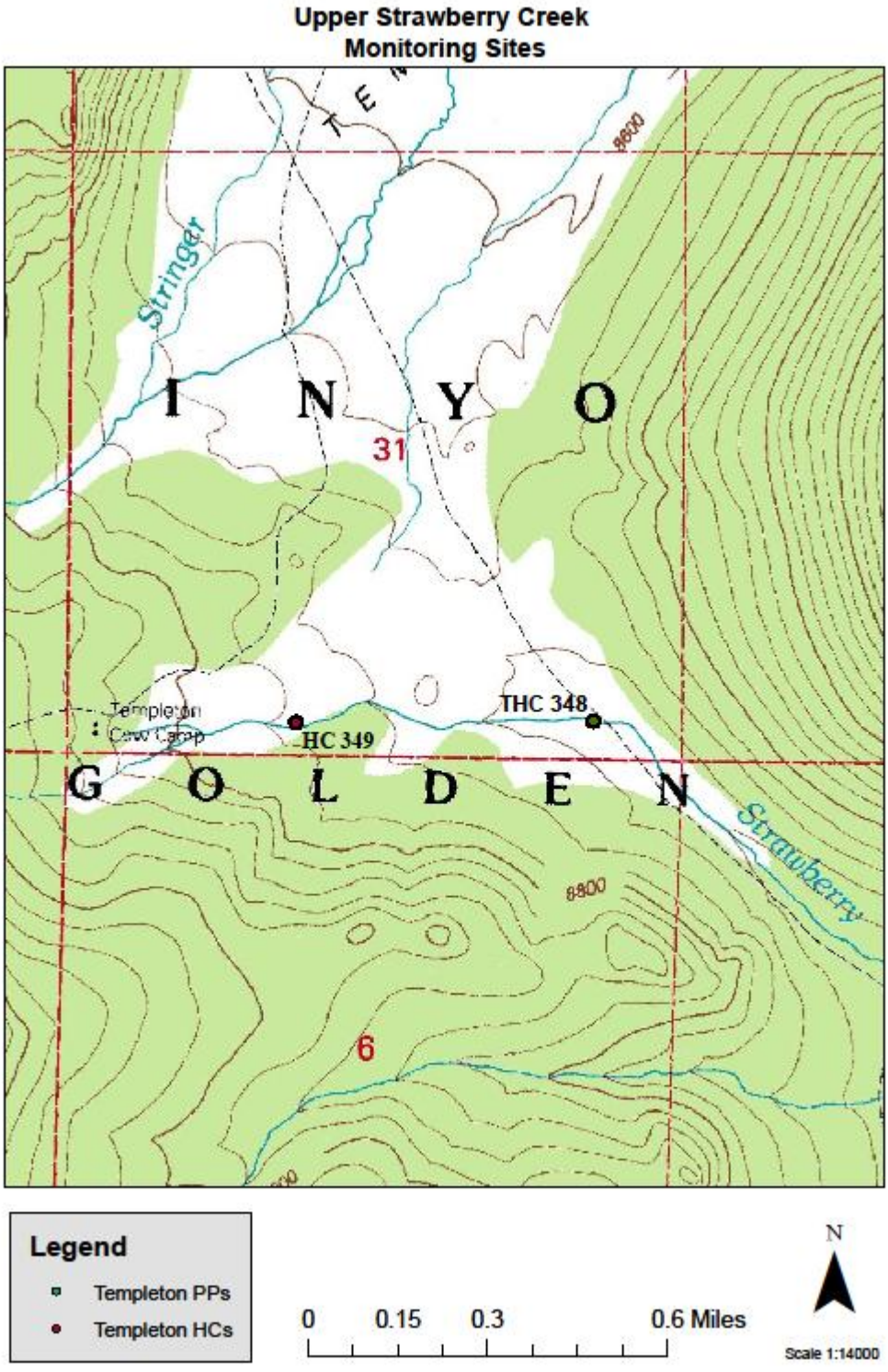
Appendix A **– Monitoring Site Location Maps**

Big Whitney - Stokes Stringer Monitoring Sites

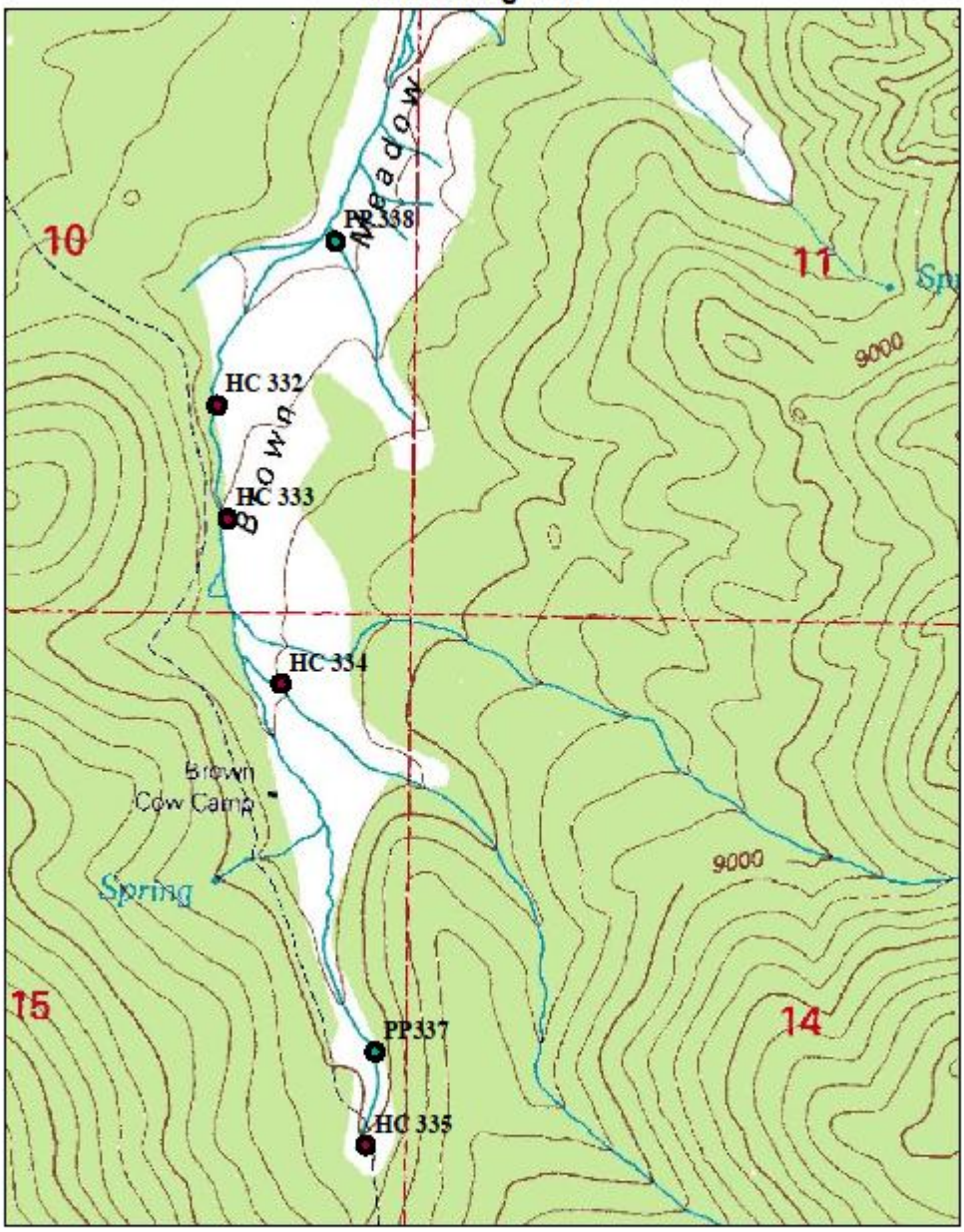


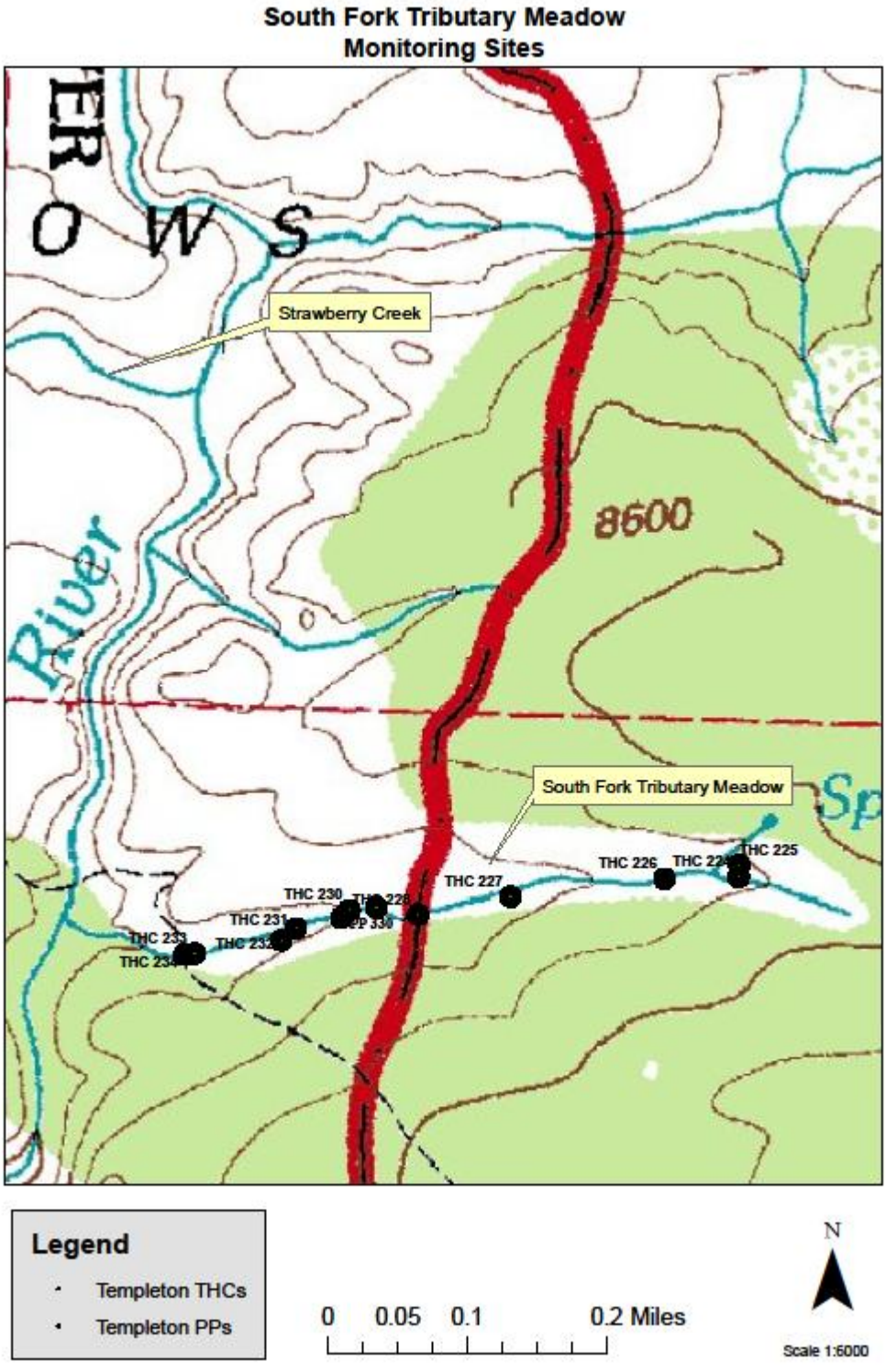
Schaeffer Meadow Headcut and Photopoint Monitoring Sites



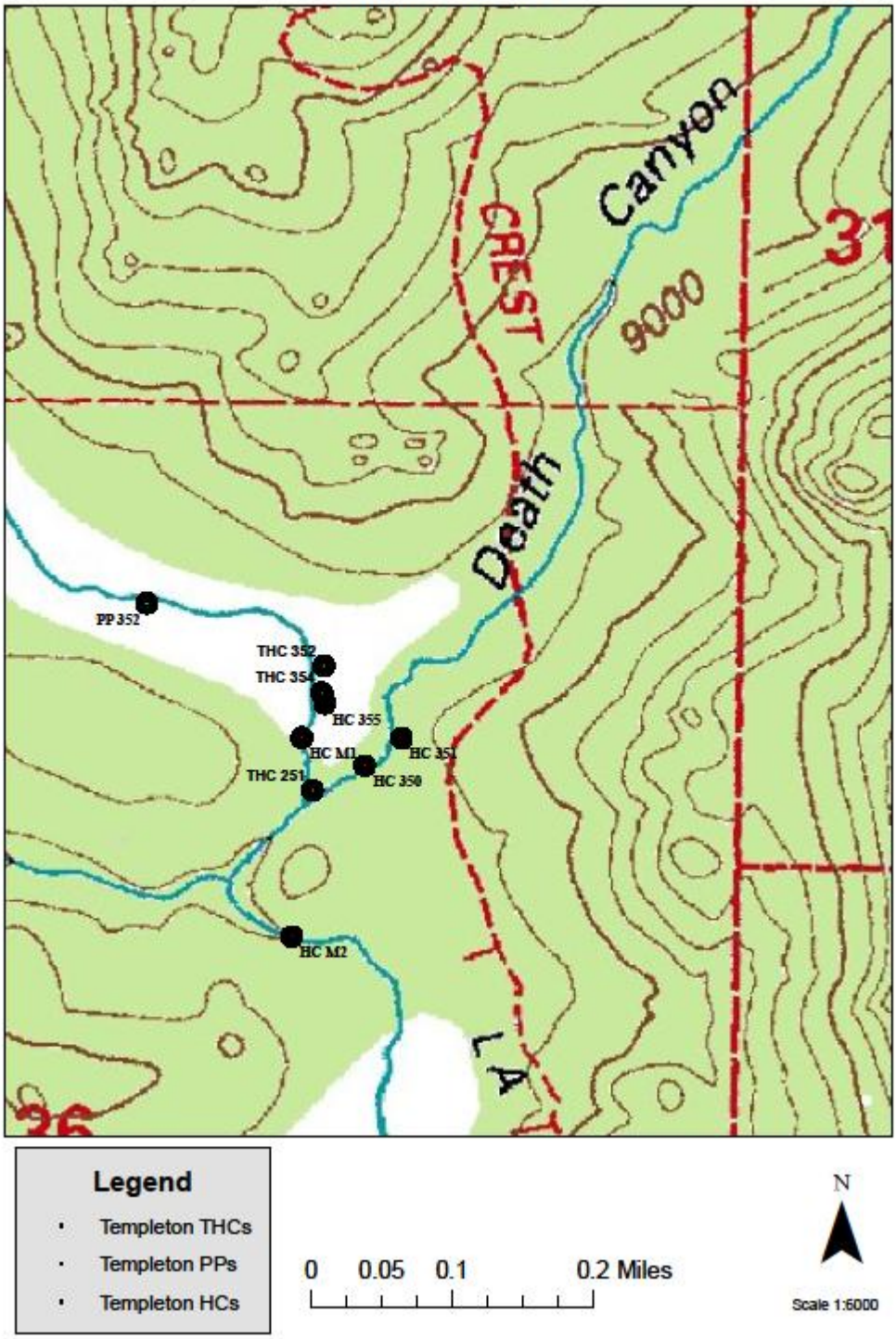

Upper Strawberry Creek
Monitoring Sites
Stringer
I N Y O
31
Templeton
Camp
HC 349
THC 348
G O L D E N
Strawberry
8800
6
Legend
Templeton PPs
Templeton HCs
0
0.15
0.3
0.6 Miles
N
Scale 1:14000

Brown Meadow Headcut and Photopoint Monitoring Sites

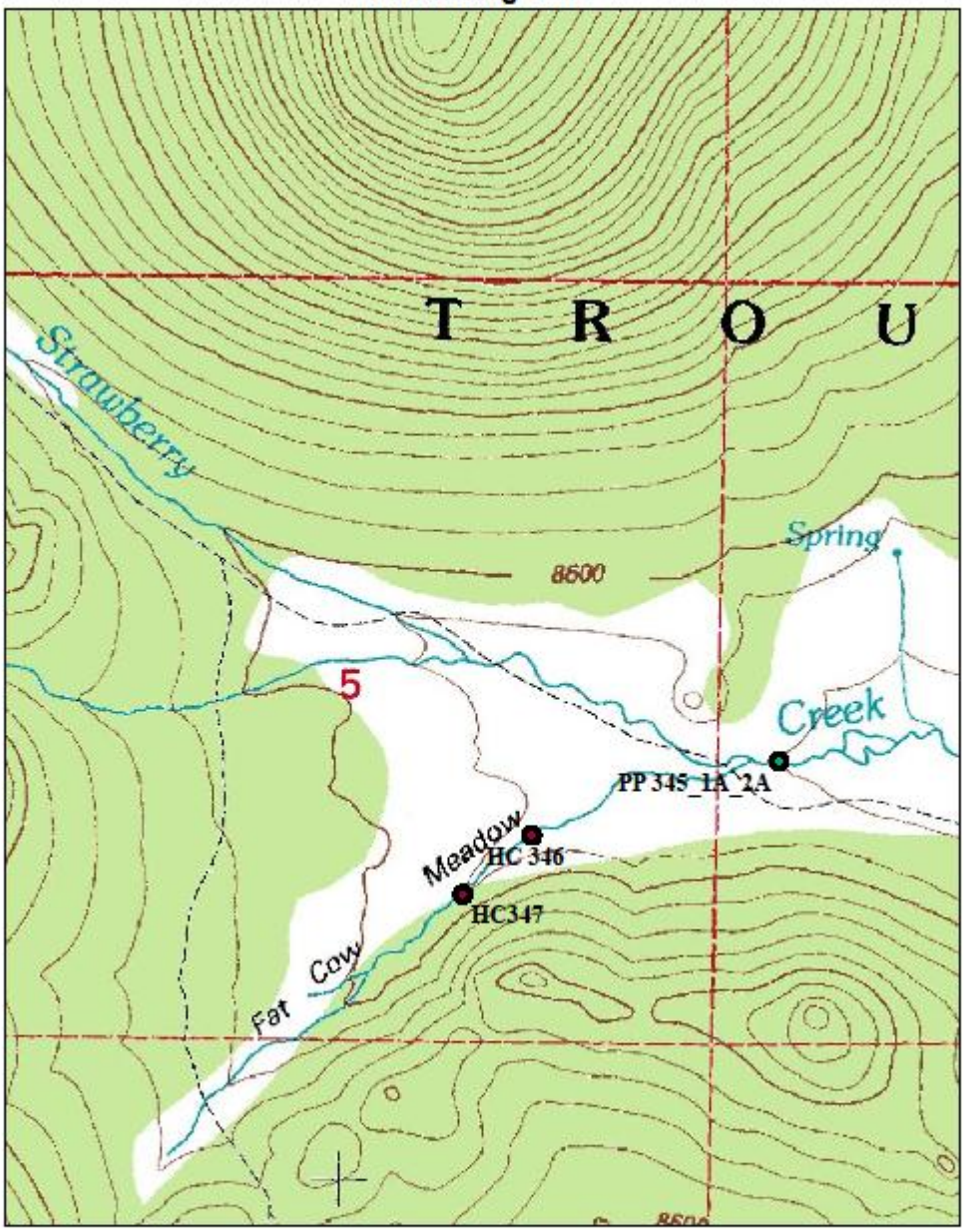



South Fork Tributary Meadow
Monitoring Sites
Strawberry Creek
8600
River
South Fork Tributary Meadow
THC 225
THC 226
THC 227
THC 230
THC 231
THC 232
THC 233
Legend
Templeton THCs
Templeton PPs
0 0.05 0.1 0.2 Miles
N
Scale 1:6000

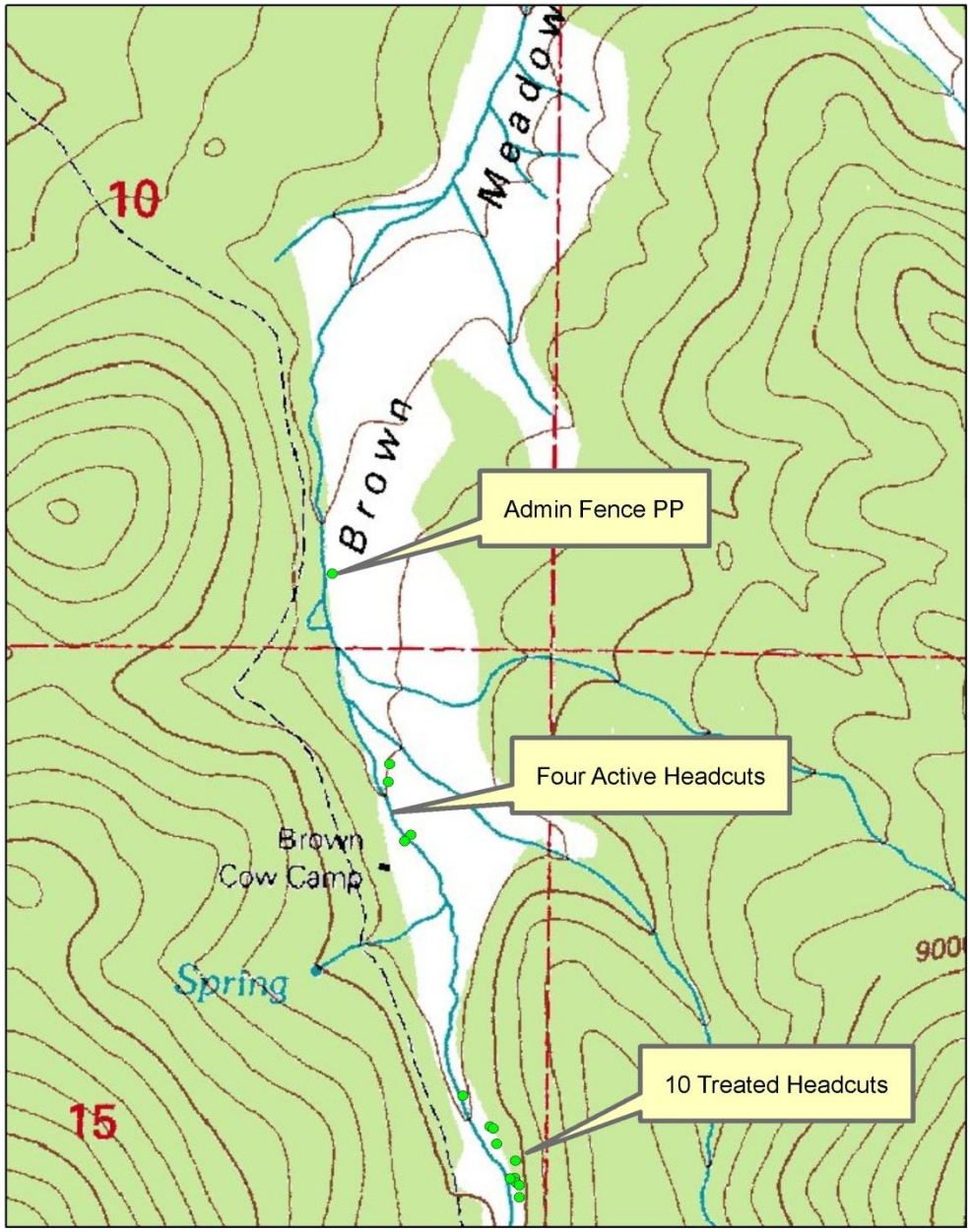
Death Canyon
Monitoring Sites



Strawberry-Fat Cow Meadow Headcut and Photopoint Monitoring Sites



Brown Meadow
Active Headcuts
Treated Headcut Locations



Appendix B - Head Cut Monitoring Site Data - Templeton and Whitney Allotments - Table 1

Head cut Site I.D. # - Monitoring Year	Meadow Name	Allotment	Slope %	Depth @ Thalweg (m) @ 2003 transect	Channel Width (m) @ 2003 transect	Depth @ Thalweg (m) (top of 2010 gully)	Channel Width (m) (top of 2010 gully)	HC Migration Distance since 2003 (length m)	Est. soil loss volume since 2003 (cu. m)
TEMPLETON SITES									
332-2003	Brown	Templeton	2	0.48	0.44				
332-2010	Brown	Templeton	"	0.85	0.65	0.70	0.80	**9.05**	**5.03**
Difference				0.37	0.21				
333 - 2003	Brown	Templeton	2	0.82	0.38				
333 - 2010	Brown	Templeton	"	1.15	0.44	0.65	0.40	**1.07**	**0.41**
Difference				0.33	0.06				
334 - 2003	Brown	Templeton	4	1.5	2.58				
334 - 2010	Brown	Templeton	"	1.39	4.02	1.50	1.25	**3.90**	**14.55**
Difference				-0.11	1.44				
335 - 2003	Brown	Templeton	4	0.75	0.80				
335 - 2010	Brown	Templeton	"	0.90	0.89	0.00	0.00	**0.00**	**0.00**
Difference				0.15	0.09				
339 -2003	Schaeffer	Templeton	3	0.72	0.67				
339-2010	Schaeffer	Templeton	"	1.24	0.66	0.80	0.50	**0.55**	**0.34**
Difference				0.52	0.00				
340 - 2003	Schaeffer	Templeton	3	0.70	1.10				
340 - 2010	Schaeffer	Templeton	"	1.25	1.82	1.70	1.35	**1.90**	**4.34**
Difference				0.55	0.72				
343 - 2003	Schaeffer	Templeton	4	0.82	0.53				
343 - 2010	Schaeffer	Templeton	"	1.88	1.42	0.72	0.32	**1.25**	**1.81**
Difference				1.06	0.89				
344 - 2003	Schaeffer	Templeton	3	0.85	0.39				
344-2010	Schaeffer	Templeton	"	1.56	1.94	0.93	0.45	**0.95**	**1.64**
Difference				0.71	1.55				
346-2003	Fat Cow	Templeton	3	0.61	0.97				
346-2010	Fat Cow	Templeton	"	1.31	2.69	0.55	2.10	**0.85**	**1.99**
Difference				0.7	1.72				
347-2003	Fat Cow	Templeton	3	0.60	0.62				
347-2010	Fat Cow	Templeton	"	0.99	0.74	0.45	0.60	**0.45**	**0.23**
Difference				0.39	0.12				
349 - 2003	Strawberry	Templeton	5	0.55	0.55				
349 - 2010	Strawberry	Templeton	"	1.11	0.37	0.25	0.40	**0.33**	**0.08**
Difference				.56	-0.18				

Head cut Site I.D. # - Monitoring Year	Meadow Name	Allotment	Slope %	Depth @ Thalweg (m) @ 2003 transect	Channel Width (m) @ 2003 transect	Depth @ Thalweg (m) (top of 2010 gully)	Channel Width (m) (top of 2010 gully)	HC Migration Distance (length m)	Est. soil loss volume since 2003 (cu. m)
350 - 2003	Death Canyon	Templeton	2	0.89	0.38				
350-2010	Death Canyon	Templeton	"	1.24	1.23	0.80	1.05	**1.22**	**1.44**
Difference				0.35	0.85				
351 - 2003	Death Canyon	Templeton	2	0.40	0.89				
351-2010	Death Canyon	Templeton	"	1.31	2.05	0.25	0.45	**2.22**	**3.11**
Difference				0.91	1.16				
355 - 2003	Death Canyon	Templeton	2	0.39	0.85				
355-2010	Death Canyon	Templeton	"	1.08	1.63	1.23	0.95	**1.83**	**2.68**
Difference				0.69	0.78				
WHITNEY SITES									
375 - 2003	Stokes Sec 1		2	0.80	0.85				
375-2010	Stokes Sec 1	Whitney	"	0.78	1.99	0.40	0.80	**46.00**	**43.06**
Difference		Whitney		-0.02	1.14				
377 -2003	Stokes Sec 2		2	0.57	0.52				
377-2010	Stokes Sec 2	Whitney	"	1.42	0.27	0.50	0.40	**23.50**	**6.85**
Difference		Whitney		0.85	-0.25				
378 - 2003	Stokes Sec 2		2	0.62	0.36				
378-2010	Stokes Sec 2	Whitney	"	1.15	0.43	0.54	0.50	**3.60**	**1.38**
Difference		Whitney		0.53	0.07				
380 - 2003	Big Whitney Sec 2		1	0.64	0.90				
380 - 2010	Big Whitney Sec 2	Whitney	Recent organic/sediment deposition from flooding at site and shift in channel alignment prevented 2010 data collection, unable to locate transect monuments.						
383 - 2003	Big Whitney Sec 1	Whitney	2	0.52	0.55				
383 - 2010	Big Whitney Sec 1	Whitney	"	0.74	0.35	0.57	0.40	**1.07**	**0.26**
Difference					-0.2				

Appendix C – Table 2

Precipitation Data-Maximum Snow Water Content (SWC) in inches, 2004 -2010
Snow Surveys, State of California - Kern Plateau Sites
(Reference: California Data Exchange Website, Department of Water Resources, 2011)

Data Site	2004	2005	2006	2007	2008	2009	2010	April 1 Average SWC	Years Above Average April 1 SWC (since 2003 – 7 years)
Big Whitney Meadow	**16**	**30**	**26.5**	**3**	**20**	**13.5**	**19**	**17.2**	**4**
Cottonwood Pass	**13**	**30.5**	**21.5**	**7.5**	**14**	**9**	**18.5**	**14.8**	**3**
Tunnel Station	**13**	**25.2**	**21.5**	**5.5**	**19**	**11**	**18**	**15.6**	**4**
Ramshaw Meadow	**28.4**	**26.5**	**23.5**	**16.5**	**17**	**11**	**17**	**11.5**	**6**
Casa Vieja Meadow	**20.5**	**30**	**32**	**10**	**26**	**16**	**28**	**19.8**	**5**
Trail Head (east of Templeton Meadow)	**13**	**26.6**	**15**	**2.5**	**16**	**9**	**15**	**13.2**	**4**

Note: Data is for showing years of above average precipitation at snow survey sites of the Kern Plateau region to compare headcut migration rates. All sites are showing at least 50 % of the water years were above average (except Cottonwood Pass). SWC maximums are based on April 1 or peak measurement of yearly amounts.